



Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/11458
DOI URL: <http://dx.doi.org/10.21474/IJAR01/11458>



RESEARCH ARTICLE

ADOPTION BEHAVIOUR OF FARMERS TO CLIMATE SMART AGRICULTURAL PRACTICES IN ODISHA

Anmol Panda¹, Nagesha G.² and Shivamurthy M³

1. Ph.D. Scholar, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand.
2. Assistant Professor, Department of Agricultural Extension, CoA, VC Farm, Mandya.
3. Rtd. Professor and Head, Department of Agricultural Extension, GKVK, UAS Bangalore, Karnataka.

Manuscript Info

Manuscript History

Received: 31 May 2020
Final Accepted: 30 June 2020
Published: July 2020

Key words:-

Adoption Behaviour, Climate Smart Agricultural Practices, Rice Pulse Farming System, ICTs, Innovative Proneness and Extension Participation

Abstract

In the recent past, the agricultural scenario in the country is being challenged due to climatic aberrations. The impact of climate change on farming communities can be reduced by distributing timely information about seasonal climate forecast to farmers, so that they can make precise farming decisions and adopt to changing conditions. On this background, a study was conducted to assess the adoption behaviour of farmers to climate smart agricultural practices in coastal Odisha. The study reveals that characteristics like size of holding, material possession, extension participation, cosmopolitanism, animal herd size and ownership and extent of utilization of ICTs were influenced the adoption behaviour of Climate Smart Agricultural Practices of rice pulse farmers. The study recommended organizing capacity building programmes related to Climate Smart Agricultural technologies, timely generation and dissemination of information on climate change issues as strategies for enhancing adaptation to climate change.

Copy Right, IJAR, 2020,. All rights reserved.

Introduction:-

India with a broad and diverse cropping pattern has occupied the first place in area and second place in production of rice after China, contributing 28.53 percent of the world's area and 14.61 per cent of world's production with 44.19 million hectares area and 104.4 million tones Production, respectively (INDIASTAT, 2016). However, in recent past the agricultural scenario in the country is being challenged due to climatic aberrations. The impact of climate change on farming communities can be reduced by distributing timely information about seasonal climate forecasts to farmers, so that they can make more informed farming decisions and adapt to changing conditions. And those farmers with access to both input and output markets have more chances to implement adaptation measures. Input markets allow farmers to acquire the necessary inputs they might need for their farming operations such as different seed varieties, fertilizers, and irrigation technologies (Nhemachena and Haasan, 2007) These components address the issues related productivity, one of the three pillars of climate smart agriculture (FAO, 2013).

Climate-smart agriculture seeks to maximize synergies and minimize trade-offs in addressing food security, development and climate change adaptation/mitigation challenges. Climate Smart Agriculture (CSA) is an applied set of farming principles and practices that increases productivity in an environmentally and socially sustainable way (adaptation); strengthens farmers' capacities to cope with the effects and impacts of climate change (resilience); conserves the natural resource base through maintaining and recycling organic matter in soils (carbon storage); and,

Corresponding Author:- Anmol Panda

Address:- Ph.D. Scholar, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand.

as a result reduces greenhouse gas emissions (mitigation) (Sullivan et al., 2013). CSA at the local level can be conceived as a set of practices assessed for local suitability that can improve a farmer's adaptation to changes in climate or increase the mitigation potential of production through carbon sequestration or reduced emissions meeting or exceeding food security goals. At the national or regional level, CSA is considered a conceptual framework that examines the tradeoffs between the three "pillars" of adaptation, mitigation and food security (Peterson, 2014).

Critically, emphasis should focus on adaptation because human activities have already affected climate, climate change continues given past trends, and the effect of emission reductions will take several decades before showing results, and adaptation can be undertaken at the local or national level as it depends less on the actions of others (Fussler, 2007). Among the Indian states, Odisha has been identified as one of the most climatically vulnerable states having coastal districts often witnessing extreme climatic events (Pattnaik and Narayanan, 2005). According to Das and Ghosh (2018), livelihood of farm households in coastal districts of Odisha was found more sensitive compared to the non coastal districts as revealed by impact-exposure matrix.

On this backdrop, a study was conducted to assess the adoption behavior of farmers to climate smart agricultural practices in coastal Odisha.

Methodology:-

Rice growing situations prevailing in different regions of India largely determine the system of cultivation. The two principle systems adopted in the state of Odisha are dry and wet season rice cultivation systems. Puri district of Odisha is a major producer of Rice and Pulses covering an area of 1.42 lakhs hectares of Rice and 70,800 hectares of pulses production (Anon, 2017). However, farmers in the district are frequently affected by erratic rainfall, water logging problems, salinity problems, wrong agronomic practices, flash floods and cyclonic storms during October-November which has led to decrease in yields of field crops ultimately affecting profit of farmer.

And thus, there a much needed intervention of climate smart agricultural practices and its adoption was felt and the present study was conducted in Puri district of Odisha which was purposively selected due to its location in coastal agro-ecosystem as well as being one of the agriculturally prosperous districts. Assistant Agriculture Officers (AAOs) of randomly selected three taluks viz; Pipili, Nimapara and Gop were consulted while selecting villages, where farmers were adopting farm practices and technologies suggested by consulting subject matter specialists of department of agronomy, soil science and agricultural extension, either partially or fully. From each of the selected taluks three villages were selected by applying simple random sampling technique. From each of these selected villages ten rice-pulse growers were randomly selected as respondents for the study and thus 90 farmers constituted the sample for study. Besides, ten extension personnel in the cadre of Agriculture Officers (AOs) and Assistant Agriculture Officers (AAOs) from each of the three taluks were selected randomly. Thus the total number of extension personnel considered for the study was 30.

In the present study adoption referred to actual use of Climate Smart Agricultural Technologies in Rice-Pulses cropping system. The technologies were selected from package of practices and other review of literature after discussing with Subject matter specialists and Extension personnel of University of Agricultural Sciences Bangalore, Orissa University of Agriculture, National Rice Research Institute and Govind Ballabh Pantnagar University of Agriculture and Technology. Adoption behavior stating full, partial and no adoption was scored as 3,2,1 respectively and depending upon the total scores obtained by each one of the respondents, they were grouped into three categories considering mean and standard deviation as a measure of check along with frequency and percentage calculation for each item of the adoption test. The independent variables in the study included Age, Education, Family size, Family type, Size of Land Holding, Innovative Proneness, Material Possession, Farming experience, Extension Participation, Achievement Motivation, Risk Orientation, Scientific Orientation, Cosmopolitaness, Animal herd size, Ownership and extent of utilization of ICTs. The factors having significant association with adoption behavior were delineated through correlation matrix.

Results and Discussion:-

The adoption behavior of rice-pulse growers with respect to Climate Smart Agricultural Technologies in rice-pulse cropping system is presented in Table 1 and Figure 1. Nearly 35.56 per cent of farmers were low adopters, 33.33

per cent of the farmers belonged to medium adopter category and 31.11 per cent of the respondents were noticed in higher adopter category.

Table 1:- Overall adoption behavior of Rice-pulse growers with respect to Climate Smart Agricultural Technologies (n=90).

Sl. No.	Adoption Category	Number	Percentage	Mean Score	SD
1.	Low Adoption	32	35.56	58.09	8.57
2.	Medium Adoption	30	33.33	65.43	
3.	High Adoption	28	31.11	77.14	
		90	100	Overall Mean=66.47	

SD: Standard Deviation

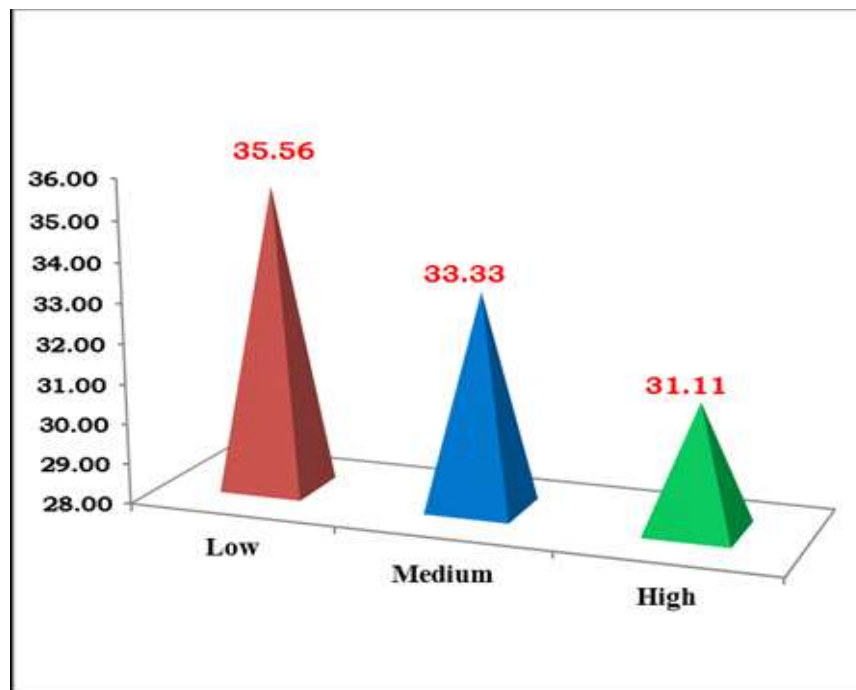


Fig 1:- Adoption of Climate smart Agricultural technologies among rice-pulse.

Farmers:

The reason for this kind of observation might be that farmers have resorted to use measures which are cost effective and remunerative. Further other reasons such as extension agency might not have educated the farmers about the climate Smart Agricultural Technologies or they might have neglected the particular technologies.

Considerable number of farmers have adopted biofertilizers, Organic fertilizers, Weed management and improved varieties of Rice and pulses. This certainly indicates gradual change in the affective domain of farmers towards using less chemical control measures.

The findings were contradicting with the studies of Marathy and Reddy (1998), Chothe and Borkar (2000), Ranganatha et al. (2001), Khan et al. (2002), Garg et al. (2009) and Shashidhara (2012).

The extent of adoption of Climate Smart Agricultural Technologies by the rice-pulse farmers is evident from Table 2. With regard to soil fertility management, it was seen that majority (81.11 %) of rice-pulse farmers had adopted compost as a organic fertilizers. Majority (64.44 %) of the respondents were using neem coated urea as slow releasing nitrogenous fertilizers, 38.89 per cent of them had adopted use of rhizobium in pulses and 32.22 per cent had adopted soil testing in their own farm. Further only 24.44 per cent of rice-pulse farmers had adopted application of green manure, 21.11 per cent had adopted application of azolla in rice crop, 4.44 per cent adopted use of

azospirillum and none of them had fully adopted Leaf colour chart (LCC) for checking nitrogen deficiency. Overall 52.8 per cent of farmers had adopted organic fertilizers and 21.5 per cent had adopted bio fertilizers.

With regard to Crop practices in Rice-pulses system, majority (60 %) of respondents had adopted summer deep ploughing and 54.44 per cent of them had adopted using herbicides in rice cultivation as a measure of weed management in rice. More than two-fifth (42.22 %) of rice-pulse farmers had maintained thin film of water to suppress weeds, 35.56 per cent of them had adopted direct seeded rice cultivation, 18.89 per cent of them had adopted System of Rice Intensification (SRI) method of cultivation and 14.44 per cent of them had adopted improved land leveling. Further only 3.33 per cent of rice-pulse farmers had adopted rotary weeder and mere 1.11 per cent of them had adopted Alternate Wetting and drying in rice cropping. None of them had fully adopted rice straw incorporation. Overall, 40 per cent had adopted weed management practices in rice.

In case of Water and water use management, 13.33 percent of rice-pulse farmers had adopted improved drainage system in rice cultivation. Further only 3.33 per cent of them had adopted rain water harvesting and only mere 1.11 per cent of them had adopted residue mulching in rice cultivation.

With regard to crop pest and disease management, 34.44 percent of rice pulse farmers had adopted growing of pest resistant varieties, 32.22 percent had raised healthy paddy nursery, 6.7 per cent of them had adopted conserving bio agents and none of them had adopted using pheromone traps and clipping of rice seedling tips as a measure of integrated pest management in rice cropping. Almost 90 per cent of the rice-pulse farmers had adopted seed treatment in rice, 33.33 per cent of them had adopted growing resistant varieties of rice and only mere 2.22 per cent of them were involved in destroying rice stubbles and vector host plants. Overall, 41.9 per cent had adopted integrated disease management practices in rice and 14.7 per cent had adopted integrated pest management practices in rice.

With regard to livestock management, more than half (51.11 %) of rice-pulse farmers had adopted improved feed for their livestock. Slightly more than quarter (26.67 %) of the respondents had adopted improved cow breeds, 11.11 per cent of them had adopted improved poultry breeds like Banaraja, 6.67 per cent of them had adopted improved goat breeds, 3.33 per cent of them had adopted improved buffalo breeds and none of them had adopted any sheep breeds. Almost one-tenth (9.6 %) of farmers had adopted improved livestock breeds.

In case of Managing diversity in farm, 36.67 per cent of rice-pulse farmers had adopted crop rotation of paddy with crops other than pulses.

In case of improved and traditional crop varieties, 80 per cent of respondents had adopted stress tolerant varieties of rice and slightly more than one-fourth (25.6 %) of respondents had adopted stress tolerant varieties of pulses. Overall 52.8 per cent of farmers had adopted improved stress tolerant varieties of rice and pulses.

More than one-third (38.89 %) of rice-pulse farmers had adopted ICT services to access weather and agro advisories and only mere 1.1 per cent of them had adopted use of biogas plant.

Table 2:- Practice wise adoption behaviour of rice-pulse growers with respect to Climate Smart Agricultural Technologies.

No.	Climate Smart Agricultural Technologies	Fully adopted		Partially adopted		Not adopted		Mean score
		No.	%	No.	%	No.	%	
I)	Soil Fertility Management							
1.	Using Neem coated urea as slow releasing nitrogenous fertilizer	58	64.44	19	21.11	13	14.44	2.50
2.	Use of Organic fertilizers	95	52.78	50	27.78	35	19.44	2.34
a.	Use of compost	73	81.11	17	18.89	0	0	2.81
b.	Use of green manure	22	24.44	33	36.67	35	38.89	1.86
3.	Soil Testing	29	32.22	29	32.22	32	35.56	1.97
4.	Use of biofertilizers	58	21.45	57	21.11	155	57.44	1.64

a.	Use of rhizobium in pulses	35	38.89	22	24.44	33	36.67	2.02
b.	Use of Azolla in rice	19	21.11	26	28.89	45	50.00	1.71
c.	Use of Azospirillum in rice	4	4.44	09	10.00	77	85.56	1.18
5.	Leaf colour chart for checking nitrogen	0	0	03	3.33	87	96.67	1.04
II) Crop practices in Rice pulses system								
1.	Direct seeded rice	32	35.56	39	43.33	19	21.11	2.14
2.	Weed management in rice	144	40.00	89	24.67	127	35.33	2.05
a.	Use of herbicides	49	54.44	37	41.11	04	04.44	2.50
b.	Summer ploughing	54	60.00	15	16.67	21	23.33	2.37
c.	Maintaining thin film of water for suppressing weeds	38	42.22	32	35.56	20	22.22	2.2
d.	Use of rotary weeder	03	03.33	05	5.56	82	91.11	1.12
3.	Improved land leveling	13	14.44	58	64.44	19	21.11	1.93
4.	System of Rice Intensification (SRI)	17	18.89	23	25.56	50	55.56	1.63
5.	Alternate wetting and Drying in irrigated rice	1	01.11	06	06.67	83	92.22	1.08
6.	Rice straw management by rice straw incorporation	0	0	04	04.44	86	95.56	1.04
III) Water and Water use management								
1.	Improved drainage system in rice	12	13.33	50	55.56	28	31.11	1.82
2.	Rain water harvesting	3	3.33	6	6.67	81	90.00	1.13
3.	Residue mulching in rice	1	1.11	4	4.44	85	94.44	1.07
IV) Crop pest and disease management								
1.	Integrated disease management	113	41.89	40	14.78	117	43.33	1.97
a.	Use treated seeds	81	90	6	6.67	03	3.33	2.82
b.	Growing disease resistant varieties	30	33.33	15	16.67	45	50	1.83
c.	Destroying rice stubbles and vector host plants to avoid pathogen build up	02	2.22	19	21.11	69	76.67	1.26
2.	Integrated Pest Management	66	14.67	66	14.67	318	70.66	1.44
a.	Raising healthy nursery	29	32.22	33	36.67	28	31.11	2.01
b.	Growing pest resistant varieties	31	34.44	14	15.56	45	50	1.84
c.	Conserving bio-agents	6	6.67	8	8.89	76	84.44	1.22
d.	Installing pheromone traps	0	0	11	12.22	79	87.78	1.12
e.	Clipping of rice seedling tips for rice stem borer	0	0	0	0	90	100	1.00
V) Livestock Management								
1.	Improved livestock feed	46	51.11	40	44.44	4	4.44	2.47
2.	Improved livestock breed	43	9.56	47	10.44	360	80.00	1.30
a.	Improved cow breeds	24	26.67	31	34.44	35	38.89	1.88
b.	Improved poultry breeds	10	11.10	8	8.80	72	80.00	1.31
c.	Improved goat breeds	6	6.67	2	2.22	82	91.11	1.16
d.	Improved buffalo breeds	3	3.33	6	6.67	81	90.00	1.13
e.	Improved sheep breeds	0	0	0	0	90	100	1.00
VI) Managing diversity in farm								
1.	Crop rotation in rice with crops other than pulses	33	36.67	16	17.78	41	45.56	1.91
VII) Improved traditional crop varieties								
1.	Introducing improved varieties (Stress tolerant varieties in drought and water logging conditions)	95	52.78	20	11.11	65	36.11	2.17
a.	Improved varieties in rice	72	80	14	15.56	4	04.44	2.76
b.	Improved varieties in pulses	23	25.56	06	6.67	61	67.78	1.58
VIII) Others								
1.	ICT services to access weather and agro	35	38.89	34	37.78	21	23.33	2.16

	advisories							
2.	Use of biogas plant	01	1.11	01	1.11	88	97.78	1.03

Correlation analysis between profile characteristics of rice-pulse growers and their overall adoption level was done and results are presented in the Table 3. Among the fifteen selected variables, five characteristics namely size of holding, material possession, extension participation, achievement motivation, animal herd size were positively and significantly related to adoption level of rice-pulse growers at 1 per cent level of significance and three characteristics namely Scientific orientation, cosmopoliteness, and ownership and extent of utilization of ICTs were positively and significantly related to adoption level at 5 per cent level of significance.

Table 3:- Relationship between personal and socio-psychological characteristics of rice-pulse growers with adoption of Climate Smart Agricultural Technologies.

	Personal Socio-psychological characteristics	Correlation Coefficient (r)
1.	Age	0.06 ^{NS}
2.	Education	0.23*
3.	Family size	0.12 ^{NS}
4.	Family type	0.00 ^{NS}
5.	Size of land holding	0.28**
6.	Innovative proneness	0.30**
7.	Material possession	0.45**
8.	Farming experience	0.01 ^{NS}
9.	Extension Participation	0.46**
10.	Achievement Motivation	0.30**
11.	Risk Orientation	0.16 ^{NS}
12.	Scientific Orientation	0.22*
13.	Cosmopoliteness	0.15 ^{NS}
14.	Animal herd size	0.28**
15.	Ownership and extent of utilization of ICTs	0.22*

Significant at 0.05 level

Significant at 0.01 level

NS Non-Significant

Size of holding was positively and significantly related with the adoption behaviour of rice-pulse farmers. This may be explained by the fact that the farmers who have more acres of land will have more opportunities to adopt Climate Smart Agricultural Technologies in their own setting. These findings was in confirmatory with the findings of Satish (1990), Ranganath (1997) and Saikrishna (1998).

Material possession of rice-pulse farmers was positively and significantly related with their adoption behaviour. This may be explained by the fact that the farmers who are having better and more number of agricultural implements, better house and other materials like TV, radio etc. will have more opportunities to implement Climate Smart Agricultural Technologies in efficient and effective way. These findings were in confirmatory with the findings of Dwarkanath (1987) and Muttana (2013).

Extension participation of farmers was positively and significantly related with their adoption behaviour. This may be explained by the fact that farmers participating in the extension activities like demonstrations, field trips, trainings, etc. might have increased the chances to adopt Climate Smart Agriculture technologies which are recommended by extension agency. This finding was in confirmatory with the findings of Yogananda (1992) and Krishnamurthy (1999).

Achievement motivation of farmers was positively and significantly related with their adoption behaviour. The possible reasons may be the farmers having higher achievement motivation will have tendency to adopt Climate Smart Agricultural Technologies which will help them to accomplish their goals. These finding was in confirmatory with the findings of Jagannath Rao (1995) and Chandregowda (1996).

Scientific orientation of farmers was positively and significantly related with their adoption behaviour. As the individuals become more scientific in his way of thinking, he will have attraction towards the scientific techniques like climate smart agriculture technologies which are highly scientific in nature respectively increases its adoption. This finding was in confirmatory with the findings of Pandya and Vekaria (1994) and Pathak (2016).

Cosmopoliteness of farmers was positively and significantly related with their adoption behaviour. It may be explained as the individual which have access to information about agriculture technologies from different places might have resulted in higher adoption. This finding was in confirmatory with the findings of Garg et al. (2009) and contradicts with Bhatia (2015).

Animal herd size was positively and significantly related with their adoption behaviour. The possible reasons may be the farmers having more number of livestock are interested to adopt practices related to animals and farm production. This finding was in confirmatory with the findings of Saxena et al. (2000) and Ranganath et al. (2001).

Ownership and extent of utilization of ICTs of farmers was positively and significantly related with their adoption behaviour. The possible reasons might be that ICTs like radio, TV; mobile phones etc. might provide timely and need based information regarding climate Smart Agricultural Technologies. Hence, farmers who have ownership and better utilization of ICTs adopt technologies well. This finding was in confirmatory with finding of Yadav et al. (2006).

Thus, of fifteen independent variables considered to study the adoption behavior of farm households, eight variables namely size of holding, material possession, extension participation, achievement motivation, scientific orientation, cosmopoliteness, animal herd size and ownership and extent of utilization of ICTs are significantly related with the adoption behavior.

Conclusion:-

Majority of rice-pulse growers were low to medium adopters of climate smart agricultural technologies. To manage the soil health and fertility, most farmers adopted use of compost, biofertilizers conventional cropping pattern and all traditional methods of management and none could get exposed to modern technological interventions of climate smart agricultural practices and negligible access to weather advisory services and ICT enabled technologies for a smarter agriculture, showing farmers need to be educated, convinced about the importance of climate smart agricultural technologies, about adapting to changing climate and adverse effects of changing climate etc. In the long run there is a need to provide required facilities by the State Department of Agriculture, besides providing more technical guidance through conducting demonstration in each village and follow up approach.

And with a major say of characteristics like size of holding, material possession, extension participation, achievement motivation, scientific orientation, cosmopoliteness, animal herd size and ownership and extent of utilization of ICTs on the adoption behavior of rice-pulse farmers which can be actively manipulated for better adoption of a holistic and sustainable way of farming.

References:-

1. Bhatia R., 2015, Farming knowledge and adoption of organic paddy farming practices in Haryana. Ph. D. Thesis (Unpub.), CCSHAU, Hisar.
2. Chandre gowda, K. N., 1997, A study on extent of adoption of improved cultivation practices of chrysanthemum. M.Sc. (Agri.) Thesis, (Unpub.), Univ. Agric. Sci., Bangalore.
3. Chothe, G. D. and Borkar, M. M., 2000, Constraints faced by farmers in adoption of bio-fertilizers. Maharashtra J. Ext. Educ., **19**: 298-299.
4. Das, U. and Ghosh, S. (2018). Livelihood Sensitivity Matrix: A Novel Technique for Mapping Vulnerability of Rural Households to Climate Change. Indian Journal of Extension Education, 54 (4):201-205.
5. Dwarkanath, B. V., 1987, An analysis of intermediate technology adopted by small farmers in Tumkur district of Karnataka state. M.Sc. (Agri.) Thesis, (Unpub.), Univ. Agric. Sci., Bengaluru.
6. FAO. (2013). Climate-Smart Agriculture: Sourcebook. Food and Agriculture Organization. Rome, Italy. Retrieved from <http://www.fao.org/docrep/018/i3325e/i3325e.pdf>.
7. Fussel, H., 2007, Vulnerability: A generally applicable conceptual framework for climate change research. Global Environmental Change, **17** (2): 155–167

8. Garg, S. K., Shakya, S. K., Badodiya, S. K. and Daipuria, O. P., 2009, Factors influencing adoption behaviour of farmers about organic farming. Paper presented In: National Seminar on Organic farming, RVSKVV, Gwalior.
9. Jaganatha rao, R., 1995, A study on the knowledge and adoption level of paddy farmers in Hospet taluk of Tungabhadra command area in Karnataka, M.Sc. (Agri.) Thesis (Unpub.), Univ. Agric. Sci., Bangalore.
10. Khan, M. S., Krishna, T. and Rao, P. P., 2002, Adoption pattern of eco-friendly technologies by rice growers. Agril. Ext. Review, **13**: 3-6.
11. Krishnamurthy, B., Mahadevaiha, D., Lakshminarayana, M. T. and Manjunath, B. N., 1998, Extent of Adoption of recommended practices of sugarcane cultivation by farmers. J. Ext. Educ., **9**: 2033-2036
12. Marathy, P. and Reddy, R. K., 1998, A Study on the extent of Adoption and Yield gap in paddy. J. Ext. Educ., **9**: 1925-1927.
13. Muttanna, 2013, A study on perception of climate change among farm women and its impact in production of Red gram. M. Sc. Thesis (Unpub.), Univ. Agric. Sci., Bangalore.
14. Nhemachena, C. and Hassan, R., 2007, Micro-level analysis of farmers' adaptation to climate change in Southern Africa. IFPRI Discussion Paper No. 00714, International Food Policy Research Institute, Washington, D.C.
15. Pandya, R. D. and Vekaria, R. S., 1994, Knowledge and adoption behaviour of banana growers. Maharashtra J. Ext. Educ., **6**: 153-158.
16. Pathak R., 2016, A study on knowledge and adoption behaviour of farmers using biofertilizers in Ujjain district of Madhya Pradesh. M. Sc. Thesis (Unpub.), RVSKVV, Madhya Pradesh.
17. Pattnaik, U and Narayanan, K. (2005). Vulnerability and Climate Change: An analysis of Eastern coastal districts of India. An International Workshop on Human Security and Climate Change, Oslo.
18. Peterson, C. A., 2014, Local-level appraisal of benefits and barriers affecting adoption of climate-smart agricultural practices. Technical report, Curití, Colombia.
19. Sullivan, A., Mumba, A., Hachigonta, S., Connolly, M. and Majele Sibanda, L., 2013, Appropriate Climate Smart Technologies for Smallholder Farmers in Sub-Saharan Africa. FANRPAN Policy Brief, **13** (2).
20. Ranganatha, A. D., 1997, Study on knowledge and adoption of organic farming practices among rice farmers. M. Sc. (Agri.) Thesis (Unpub.), Univ. Agric. Sci., Bangalore.
21. Ranganath, A. D., Veerbhadrach, V. and Lalitha, K. C., 2001, Adoption of organic practices by small farmers. Agricultural Extension Review, **13** (6): 3-6.
22. Saikrishna, N., 1998, Study on knowledge of paddy cultivation practice and adoption behaviour of Andhra migrant farmers in Raichur district. M. Sc. (Agri.) Thesis (Unpub.), Univ. Agric. Sci., Bangalore.
23. Satish, D., 1990, A study on the knowledge and adoption of chawki rearing practices by silkworm rearers of Bangalore district. M.Sc. (Agri.) Thesis (Unpub.), Univ. Agric. Sci., Bangalore.
24. Saxena, K. K. and Singh, R. L., 2000, Adoption of organic farming practices by farmers of Malwa region. Maha. J. Extn. Educ., **11**: 50-55.
25. Shashidhara, K. K., 2012, Adoption of Eco-friendly technologies by cotton growers. Indian Research Journal of extension education, special 10 (1): 217-222.
26. Yadav, V. P. S., Raman, R. S. and Kumar, R. 2006, Knowledge and attitude of farmers towards soil testing practices. Indian J. Extn. Educ. **6** (3): 20-21.
27. Yogananda, H. G., 1992, A study on knowledge level and adoption behaviour and training needs of coconut growers. M.Sc. (Agri.) Thesis (Unpub.), Univ. Agric. Sci., Bangalore.